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ABSTRACT

Originally designed for the gifted student, these reproducible marine biology units emphasize the use of higher order thinking skills and are appropriate for use in any classroom. Interdisciplinary in content, the units provide a broad view of marine biology. Included are two complete units, one created for the upper elementary gifted student and the other for the lower elementary gifted student. Suggestions for adapting the materials to fit other classrooms are included. Several learning modalities are designed into the materials to encourage active student participation. (CW)

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Product Oriented
through the use of:

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CONTENTS

The Premise vii

A Word to the Teacher ix

1. Rationale for Self-Directed Learning 1
2. The Format 4
3. Suggested Readings 5
4. The Interest Development Center 7
5. Getting Started 9
6. The Unit: **MARINE BIOLOGY**

UNIT I: KINDERGARTEN THROUGH THIRD GRADES 11

SUGGESTIONS FOR ADAPTING THE UNIT 37

UNIT II: GRADES FOUR THROUGH EIGHT 39

BIBLIOGRAPHY 75

7. Art Supplement 77

THE PREMISE

CHILDREN ARE ACTIVE PARTICIPANTS IN THEIR LEARNING, NOT PASSIVE VESSELS TO BE FILLED. THEY ARE ALWAYS SEEKING AND CHOOSING WHAT THEY WILL LEARN AND WHAT THEY WILL NOT LEARN. THEIR ACTIVE INVOLVEMENT IS CRUCIAL TO LEARNING. CHILDREN TEND TO BECOME PERSONALLY INVOLVED IN PROJECTS THAT APPEAL TO A VARIETY OF MODALITIES . . . READING, WRITING, BUILDING, CREATING, IMAGINING, AND REAL THINKING . . . SO A VARIETY OF EACH IS INCLUDED IN THIS SELF—DIRECTED LEARNING UNIT.

A WORD TO THE TEACHER

MARINE BIOLOGY

From the smallest plankton to the most massive whales, marine biology is the study of the flora and fauna . . . the living creatures of the ocean.

The study of marine biology includes the delicate inter-relationships between the organisms that make up the complex patterns of the food chains . . . the ecology of the sea. The sea remains a major source of food. As the earth becomes more and more populated, conserving the life support system of the sea becomes a serious concern.

Careers in marine biology and related fields are fascinating to many young people today. Much of the sea still remains a mystery, but new instruments for drilling and dredging the ocean floor make the sea one of the world's remaining frontiers.

"ONE CAN LEARN THE CAMPAIGNS OF THE CIVIL WAR WITH DATES, BATTLES AND CHARACTERS WITHOUT LEARNING ANYTHING ABOUT WHY WARS ARE FOUGHT BETWEEN FRIENDS OR WHAT IDEAS CAN BE GENERALIZED TO OTHER CONFLICT SITUATIONS."

James Gallagher,
Teaching the Gifted Child, 1974

RATIONALE FOR SELF-DIRECTED LEARNING

Our children's education must be more than the memorization of capitols of the states, the products of countries and the dates and places of past wars. Most teachers and parents would agree that what is also wanted is for children to learn to think for themselves, to organize their own time, to make wise choices, to work independently and to thoughtfully evaluate the results of their study.

OBSTACLES TO INDEPENDENT LEARNING

In spite of the teacher's best efforts, many, if not most, classroom settings are organized in such a way that students are involved in schedules and organizational plans that foster dependence rather than the independence we prefer. Students are told what is to be learned, how long it will take them to learn it, the resources are defined by the teacher and, afterwards, the teacher rather than the student decides whether the learning experience was a satisfactory and valuable one.

A LEARNING ATMOSPHERE

Each time we, as educators, focus on what our objectives are, we need to take a fresh look at our classroom mode of operation and evaluate the effectiveness of the way we teach. Quite naturally, for most of us, our teaching style has more to do with how we were taught than with what recent research has shown about the learning process. Even our good instincts have been overcome by the years of conditioning we have known in our own educational experiences.

Like a breath of fresh air, the recent findings coming from the research on the brain and how it operates are supporting our intuitive knowledge. This research is showing that our brains are receptive to learning only under certain conditions. Our job is to translate that information into a classroom atmosphere that provides:

- challenge
- freedom within structure
- trust and warmth
- opportunities to experience success
- personal involvement in the curricula

A natural transition generally occurs that transforms the former "teacher-lecturer" into a "fellow-learner". As a "fellow-learner" the teacher's role becomes one of a resource person, a facilitator and a classroom manager. In this maturing atmosphere, students gradually come to see themselves as responsible for their own learning and a foundation for self-direction is set.

• • •

At this point, a sometimes unexpected problem arises. We find the student no more ready for their independent learning than we, as teachers, were ready to allow it. This common occurrence is mentioned repeatedly in the literature dealing with programming for the gifted, an area where independent study and research are recommended as a major curricular activity (see **Suggested Reading List**: Maker (1982), Doherty & Evans (1980), and Feldhusen and Treffinger (1980).

FROM PASSIVE LEARNER TO ACTIVE PARTICIPANT (BRIDGING THE GAP)

The **ZEPHYR** self-directed study unit was developed expressly to bridge that gap . . . to transport the student from the position of passive recipient to that of an active participant in his/her own pursuit of knowledge.

Within the defined structure of each unit, the students are given opportunities to:

- make choices
- learn at their own pace
- learn in a manner more closely suited to their own learning style
- expand research skills
- use a variety of modalities
- plan their own time
- develop the skills of creative, critical and evaluative thinking
- experience whole-brain learning

Since responsibility for directing their own learning is so often an unfamiliar situation, the students will need your encouragement at the start. Generally, within six to nine weeks, most students will be well on their way from teacher dependence to self-motivation. (Beginning the venture with only a few choices, then gradually arranging the setting so that there are more and more choices, works best.) As students assume more responsibility, many teachers begin to consider the school library as just another part of the classroom . . . the benefits are many . . . from gaining a personal relationship with the librarian to learning about the enormous resources available, but often unused, in most school libraries.

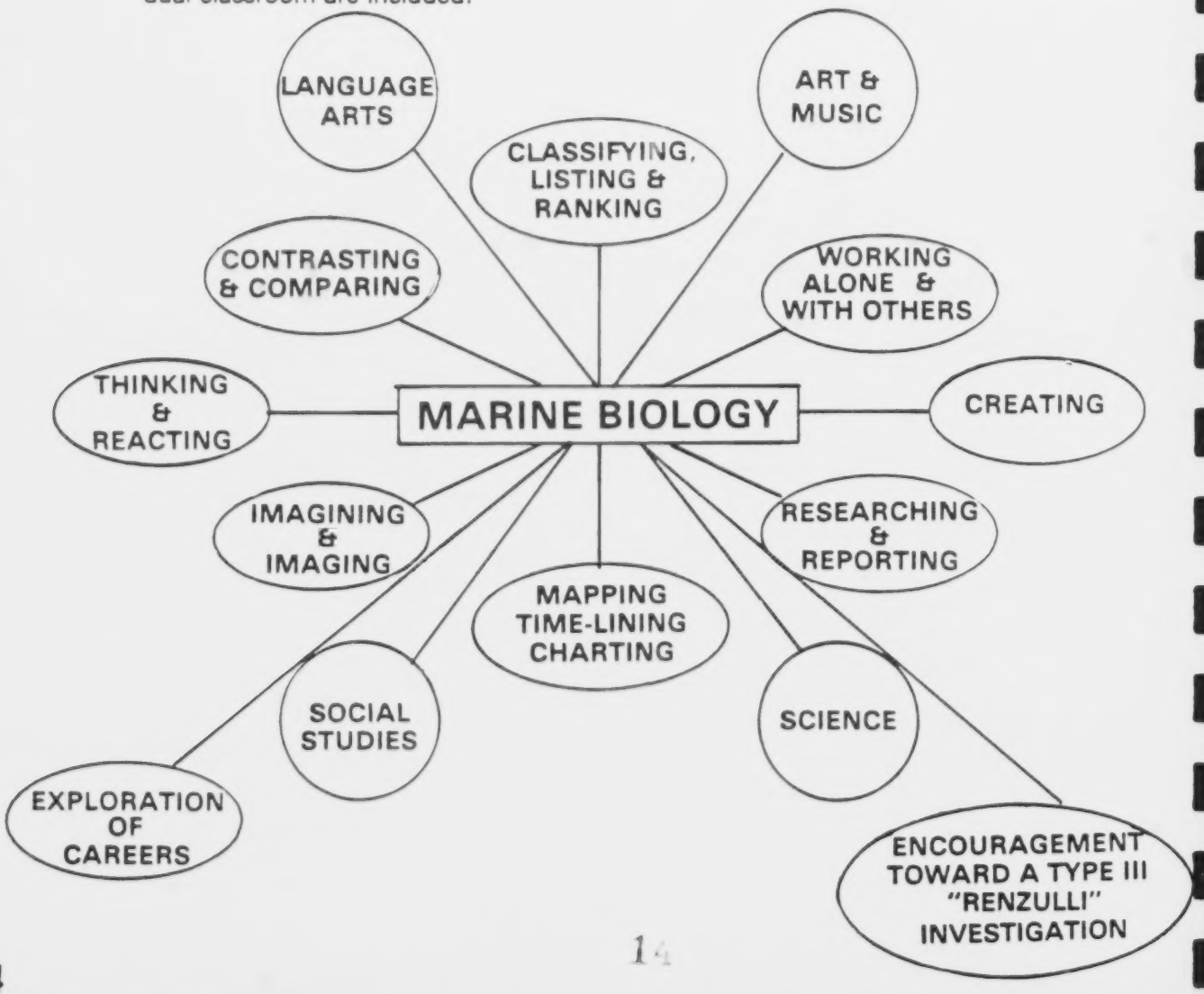
Eventually, a few students will be ready for a true investigative research study of professional quality as suggested by Joseph Renzulli in **The Enrichment Triad Model, A Guide for Developing Programs for the Gifted and Talented**, 1977.

THE FORMAT

Originally developed for the gifted student, these units emphasize the use of the higher level thinking skills . . . and are appropriate for use in any classroom where the goal is to encourage students to become responsible for their own education.

Interdisciplinary in content, the unit envelopes a broad view of the topic by integrating the "basics" into each activity.

Within this book are two complete units, one created for the upper elementary gifted student and the other for the lower elementary gifted student. Suggestions for adaptations for adjusting either of the levels to fit any individual classroom are included.



SUGGESTED READINGS

SELF-DIRECTED STUDY

"Bells, Groups and Independent Study", **Psychology and Education of the Gifted.** Barbe, W. and Renzulli, J. New York, 1975. Irvington Publishers.

Creative Questioning and Sensitive Listening Techniques. Carin, A. and Sund, R. Columbus, Ohio, 1978. Charles Merrill Publishing Company.

Creative Thinking and Problem Solving in Gifted Education. Feldhusen and Treffinger. Dubuque, Iowa, 1980. Kendall-Hunt Publishing.

Curriculum Development for the Gifted. Maker, C.J. Rockville, Maryland, 1982. Aspen Systems Corporation.

Enrichment Triad Model: A Guide for Developing Defensible Programs for the Gifted and Talented. Renzulli, J. Mansfield, Connecticut, 1977. Creative Learning Press.

Growing Up Gifted. Clark, B. Columbus, Ohio, 1978. Charles Merrill Publishing Company.

Open to Change: Options for Teaching Self-Directed Learners. Malehorn, H. Palo Alto, California, 1978. Scott Foresman Company.

Self Concept and School Achievement. Purkey. Englewood Cliffs, N.J., 1970. Prentice-Hall, Inc.

Self Starter Kit for Independent Learning. Doherty and Evans. Austin, Texas, 1980. Special Education Associates.

Teaching the Gifted Child. Gallagher, J. Boston, Massachusetts, 1975. Allyn and Bacon

INTEREST DEVELOPMENT CENTER

MARINE BIOLOGY

THE PURPOSE OF THE INTEREST DEVELOPMENT CENTER IS TO STIMULATE INTEREST IN THE TOPIC AREA. THE STUDENT NEEDS TIME FOR BROWSING AND INVESTIGATION FOR MAXIMUM BENEFIT.

(Beginning ideas . . . . . you and your students will think of more . . . . . let parents and other teachers know about the Center and it will many times grow without effort.)

BOOKS AND POSTERS:

SEA LIFE
SAILING MYTHS
TROPICAL FISH
JACQUES COUSTEAU
ACQUARIUM BUILDING
SHELL IDENTIFICATION
SEA EXPLORATION
ECOLOGY OF THE SEA
SONGS OF THE SEA
MERMAIDS
FISHING GUIDES

be sure to include books above grade level.

SHELLS AND CORAL
FISHING GEAR AND NET
AN ANCHOR
WHALE BONES
COMPASS
AN AQUARIUM
MAGNIFYING GLASS
CANNED FOODS, products of the sea

FILMSTRIPS, LOOPS AND SLIDES
MAPS
GLOBES
MAGAZINES, especially copies of National Geographic

ART SUPPLIES:

WATER COLORS AND PASTELS, ESPECIALLY

I HEAR ..... AND I FORGET
I SEE ..... AND I REMEMBER
I DO ..... AND I UNDERSTAND
(source unknown)

GETTING STARTED

1. **Select a topic** as an extension of a regular curricular subject (particularly when your class seems to crave more) . . . or . . . select a topic to pursue that is of particular interest and may not be part of the curricula. To **zero in on special interests**, administer an interest survey to each student.

2. **Copy the unit for each student.** When using these units for the entire class you may want to expand or delete activities for individual students.

3. **Set up a center** in the classroom **that encourages exploration** in the subject field. You'll want to in-include a wide variety of materials. **Be creative**, the purpose of the center is to **excite the student in this subject area** so begin with **lots of "hands on" materials . . . . allow for ample browsing time** and **encourage the student to investigate** and become absorbed . . . . **at the level of a true professional.**

4. With the students, **go over each activity** in the unit, discussing and answering any questions. The **teacher is an integral key** in successful implementation. Because most children are already well-versed in the **"One Right Answer Game"**, they will need encouragement to branch out into many of the open-ended activities in the packets.

5. **Set the stage** . . . plan to **conference as needed** . . . . **provide resources as needed** . . . . then **get out of the way** and let your students learn.

6. **Give as much time** as each student needs to complete each activity in the unit. The entire packet might take from five to ten weeks or longer.

7. As each activity is completed and evaluated, **initial the symbol** located near each activity number. You will want to **evaluate** on the basis of what response is appropriate for **that student**.

8. When a student shows an extreme interest in the topic, the completion of this unit might be only the beginning. This student may well be ready for further study and research and **needs** only the **resources, guidance and freedom** to pursue his/her well-planned project.

In preparation for further research, the student will need to decide:

WHAT WILL THE STUDY BE? (what will be investigated and produced)

WHERE WILL BACKGROUND INFORMATION BE FOUND? (i.e., speakers, interviews, books, films, microfiche, documents, etc.)

WHAT, EXACTLY, WILL BE THE FORM OF THE PRODUCT? (a model, a manuscript, or . . .)

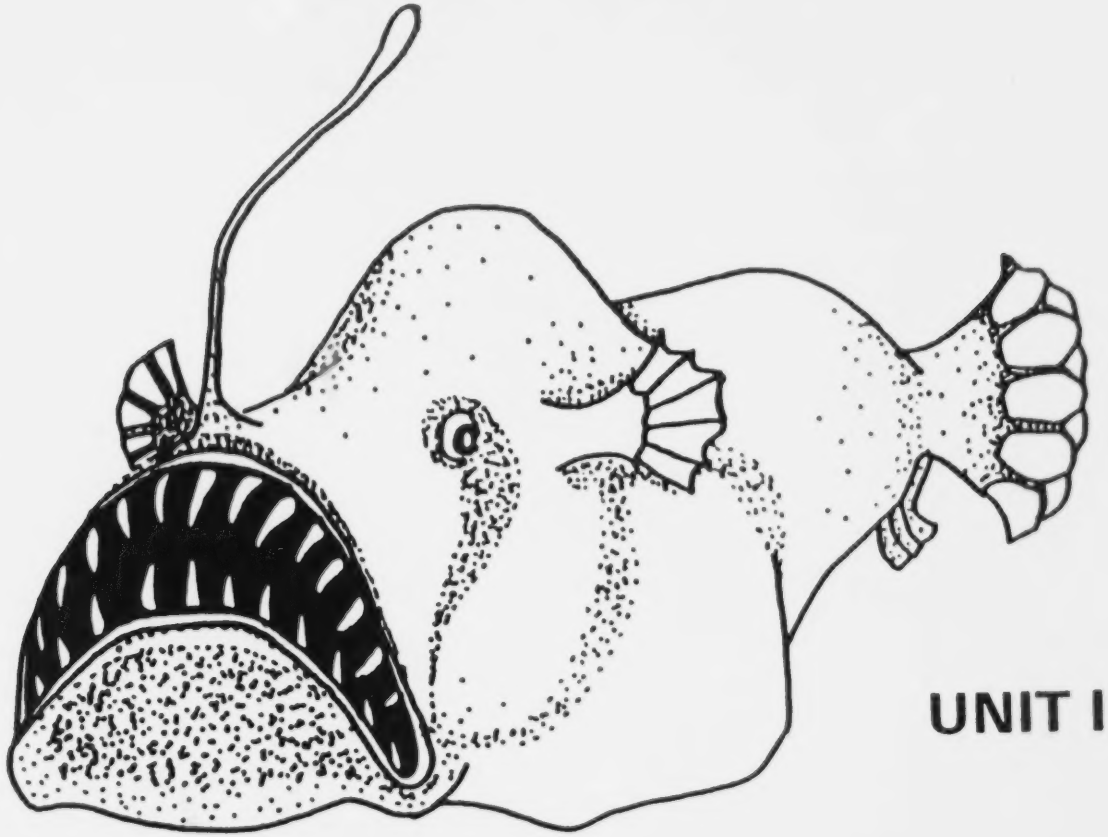
WHO MIGHT BE INTERESTED IN THE PRODUCT? (professionals in the field, publishers, organizations, etc.)

WHAT IS NEEDED TO BEGIN? (specific plans, resources, deadlines . .)

AGAIN . . . STEP BACK . . . PROVIDE GUIDANCE . . .
and LET HIM/HER GO! 18

NAME _____

DATE _____

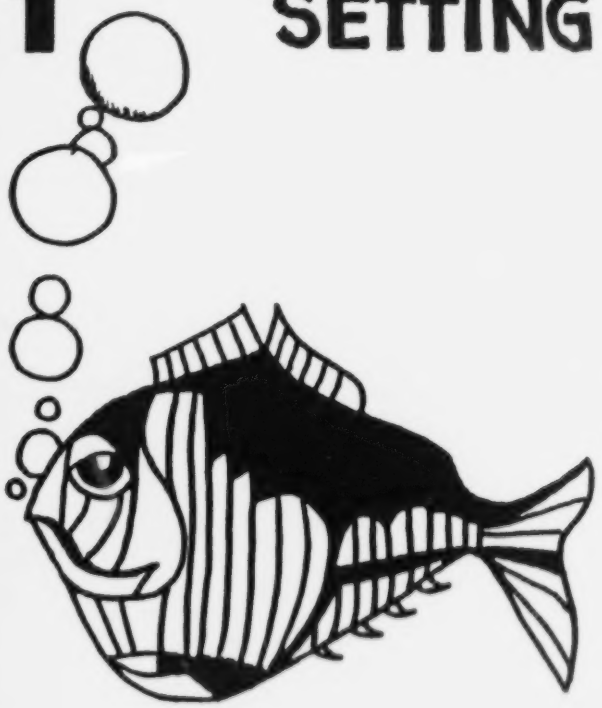


UNIT I

MARINE BIOLOGY

The following pages are to be reproduced for use in your classroom. You may want to copy directly from this book or cut the pages out first . . . then keep them in a folder to use another year.

1 SETTING THE STAGE



Have you visited the ocean? . . .
Have you tasted the salty water and breathed in the special smell of the sea?

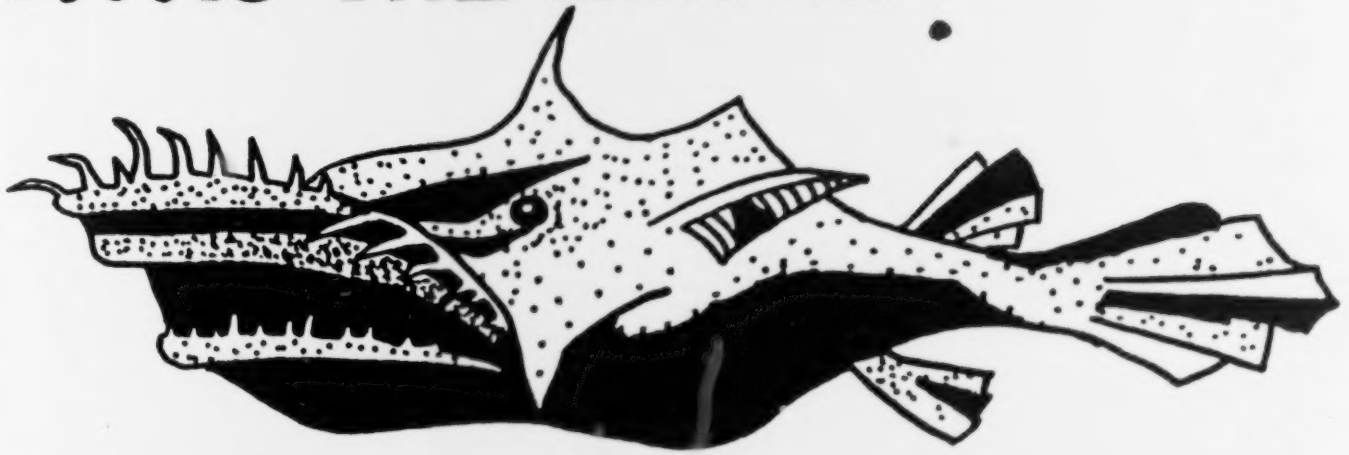
Have you dug into the wet sand and found the curious creatures there?

Have you seen and felt the shells on the seashore?

Close your eyes and imagine you are there . . . feel the moist air on your skin . . . (is it warm or cool?) . . . breathe in the air . . . let everything you want to see come to your mind . . . notice the colors . . . the smells . . . the sounds . . .

Make a list of everything you see and do.

2 Go...To THE LIBRARY!



FIND some books about:

- whales and dolphins
- the ocean
- shells
- saltwater fish
- anything else about sea life

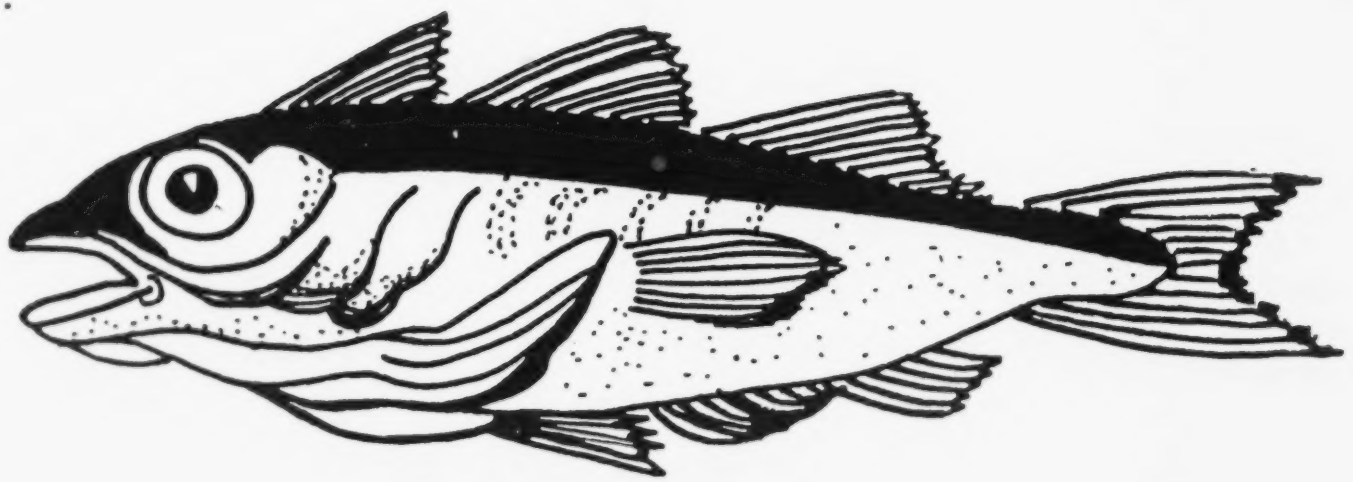
NOTICE especially:

- the parts of the sea . . . the reef . . . the abyss
- where different kinds of sea life live
- the sedentary feeders
- poisonous sea animals
- whales and dolphins
- sea shells
- the food chain of the sea
- the life cycle of the salmon

3 FIND OUT

FIND OUT ABOUT:

- ☐ the manatee
- ☐ the coelacanth
- ☐ plankton
- ☐ sea anemone
- ☐ tropical fish
- ☐ starfish
- ☐ the octopus
- ☐ jellyfish

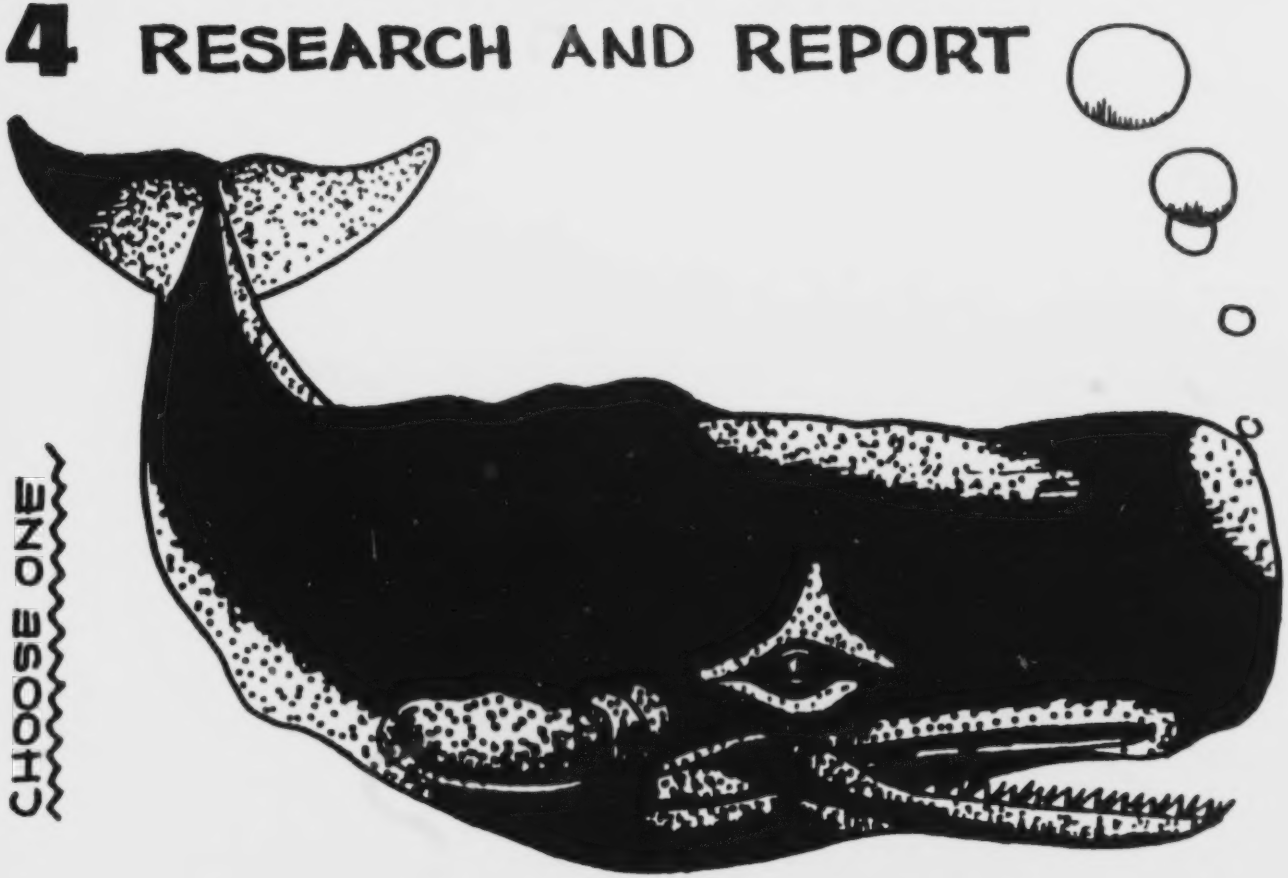


Cover a sheet of drawing paper with many bright colors of crayons . . . color it **solid**. Then cover the bright colors with black . . . **solid**.

NOW scratch an underwater scene of some of these marine animals.

(See if you can find the painting "Fish Magic" by Paul Klee.)

4 RESEARCH AND REPORT



CHOOSE ONE

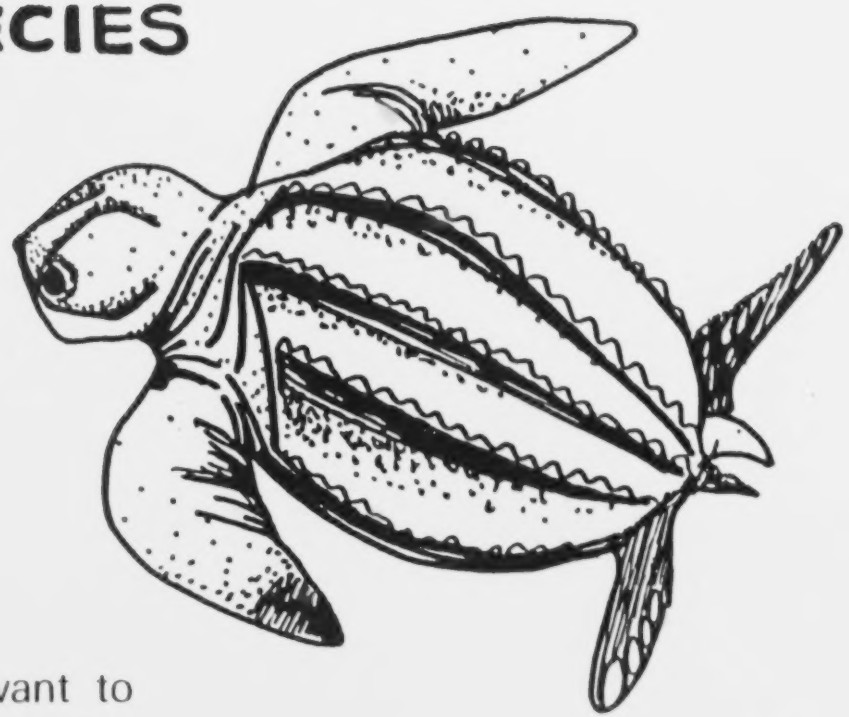
FIND OUT about poisonous sea animals. Make a chart showing what some look like. Label each one.

FIND OUT about at least two kinds of whales. Make models of them. Label each one.

FIND OUT about sea shells. Put together a collection of shells. (Ask your friends to help you find them.) Label each one.

PUT TOGETHER a display in your classroom or in the library. **INCLUDE:** Books
Pictures
Filmstrips

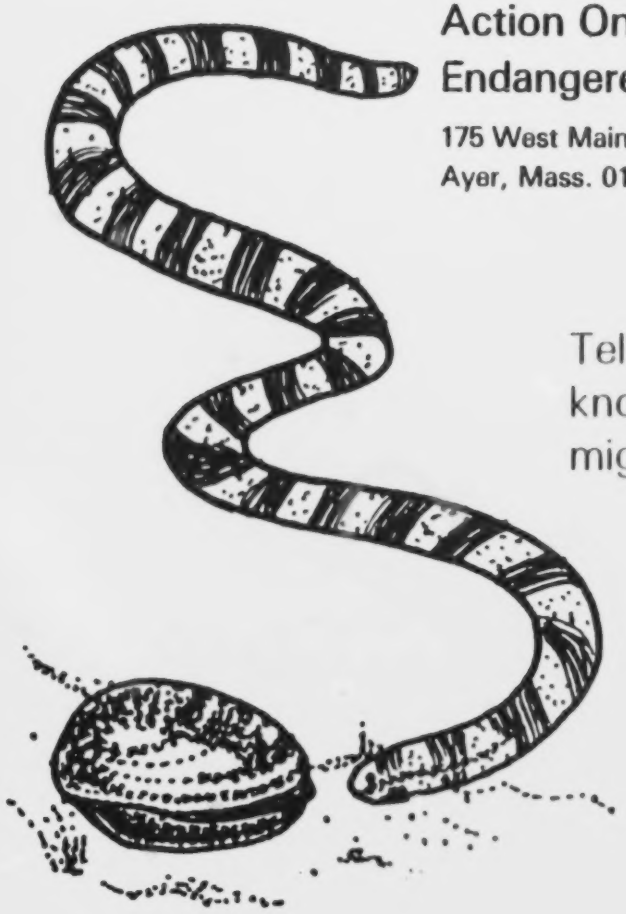
5 ENDANGERED SPECIES



WRITE a letter to —

The Center for
Action On
Endangered Species

175 West Main Street
Ayer, Mass. 01432

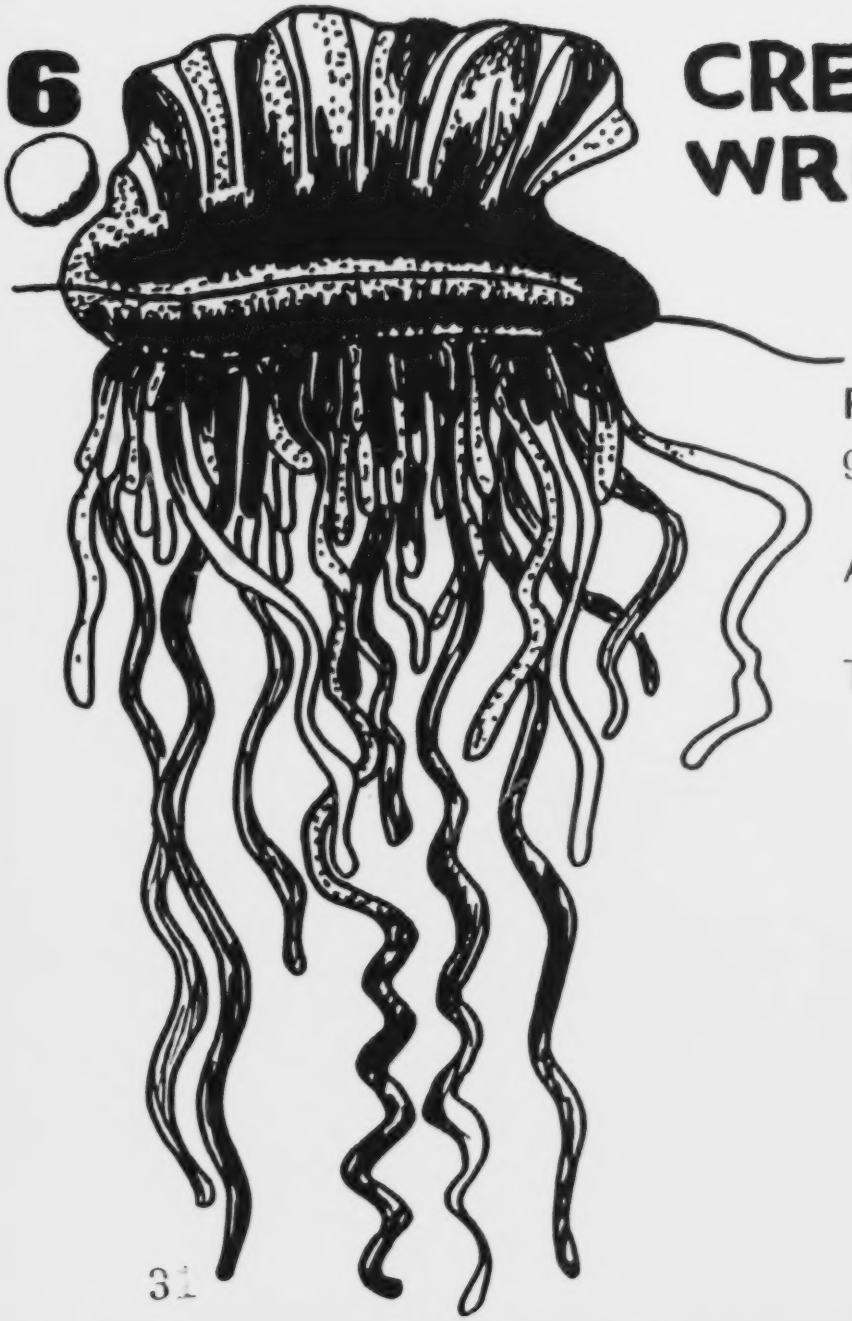


Tell them you want to know which sea animals might become extinct.

DECIDE which endangered sea animals should be saved.

MAKE a mobile showing them.

6 CREATIVE WRITING



PRETEND you are a deep sea diver. You are going into a part of the sea unknown to man.

Are you afraid? . . . excited? . . .

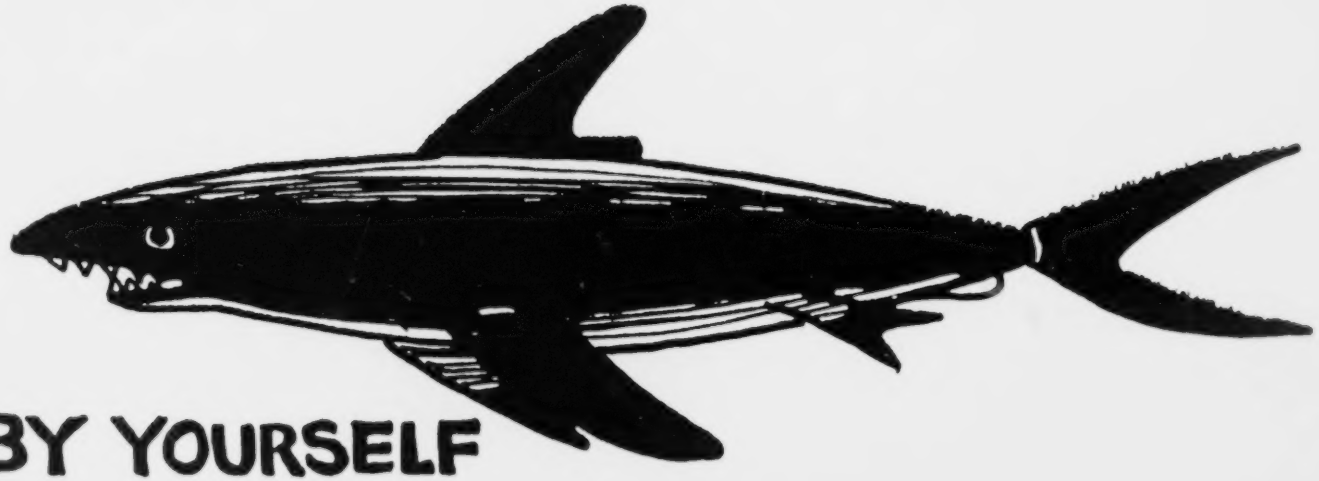
Tell the story of what happened

By making a tape (with sound effects)

OR

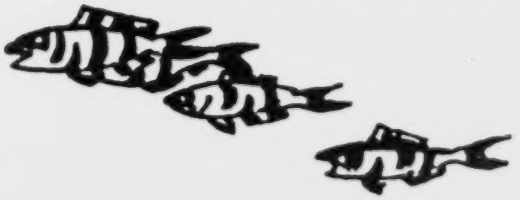
By writing a story.
(You can bind it into a book.)

7



BY YOURSELF

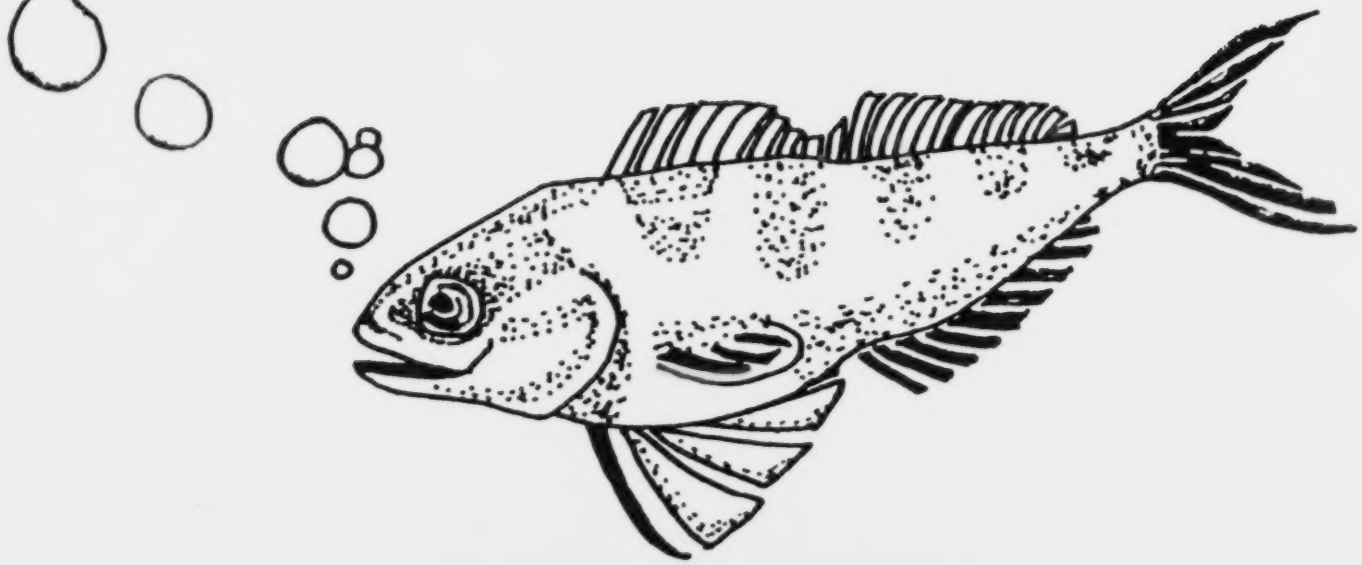
OR WITH SOME FRIENDS



Make a mural showing the "marine biome".

Show some of the sea life in each region.

8



FIND OUT ABOUT MARINE BIOLOGY

Invite a marine biologist to talk to your class.

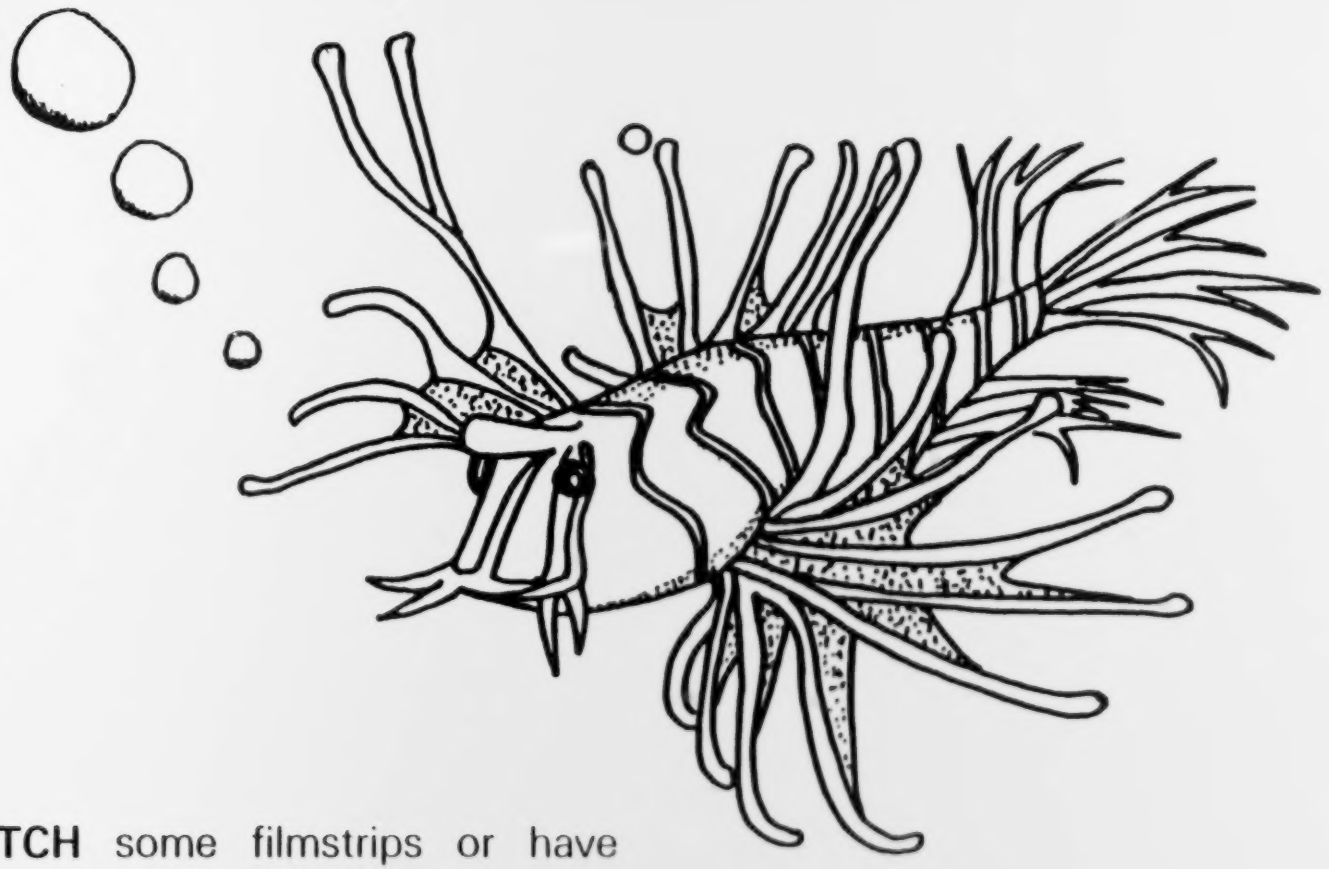
OR

Plan for your class to see a film about Jacques Cousteau.

WHAT does a marine biologist do that you would enjoy?

WHAT does a marine biologist do that you would ***not*** enjoy?

9

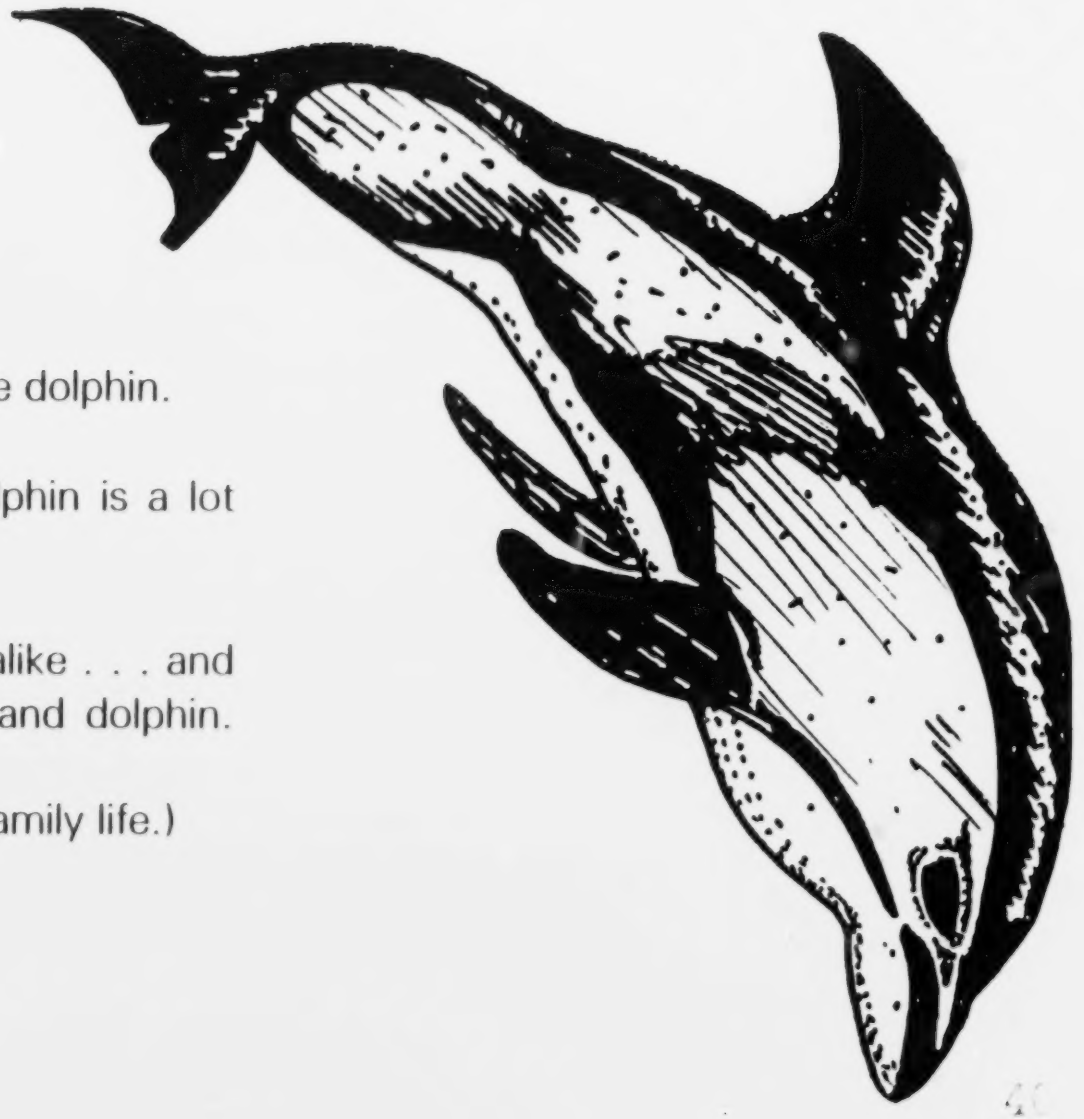


WATCH some filmstrips or have someone read some stories to you about:

- ☐ mermaids
  or
- ☐ sea nymphs

CREATE a song or poem about mermaids or sea nymphs.

10 MAN AND DOLPHIN



FIND OUT what you can about the dolphin.

Some people believe that the dolphin is a lot like man.

Present to your class what is alike . . . and what is different . . . about man and dolphin.

(Be sure you find out about their family life.)

11 WORDS FROM THE SEA

DOWN

1. Dangerous to man

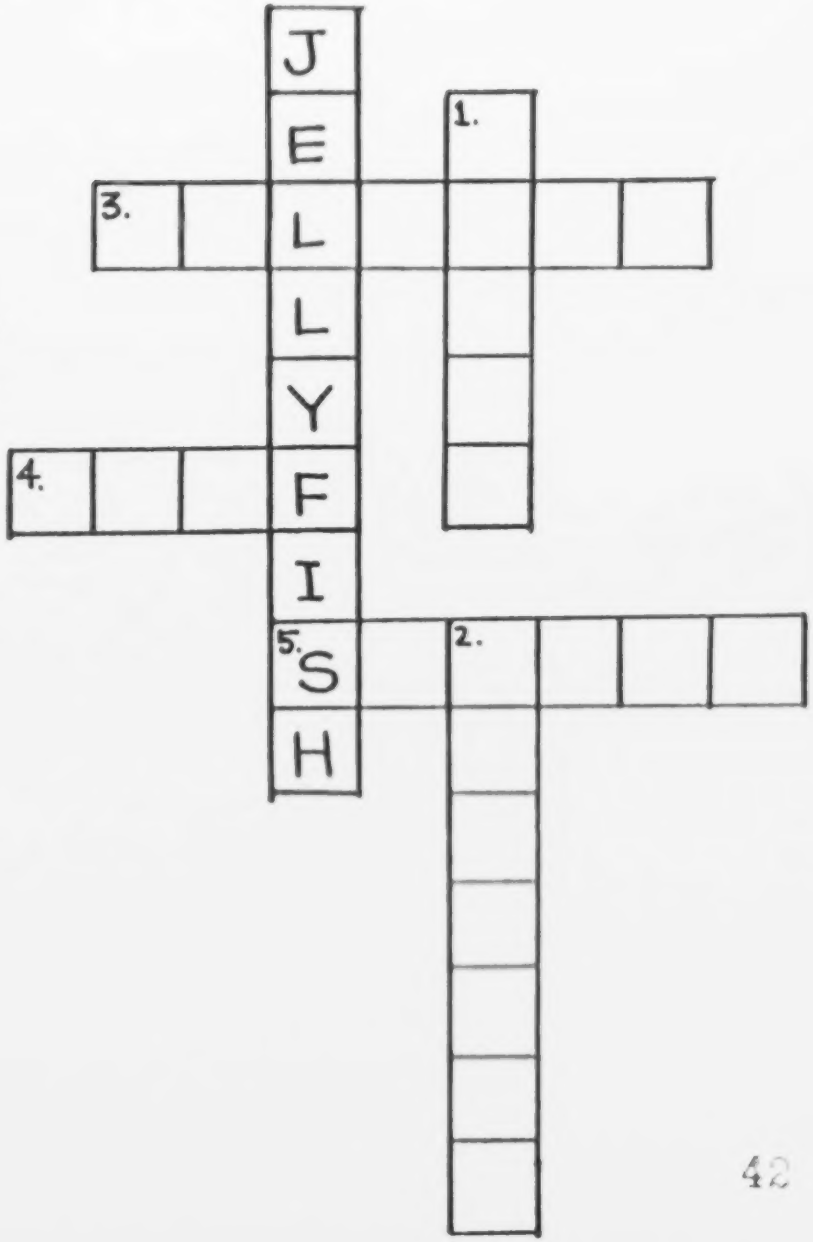
2. A sea animal with a hard shell and claws.

ACROSS

3. Very intelligent sea animal.

4. A region of the ocean filled with coral.

5. A fish that swims upstream to mate and die.



SUGGESTIONS FOR ADAPTING THE UNIT TO YOUR PARTICULAR TEACHING-LEARNING SITUATION

1. Require fewer, or more, research sources.

2. Assign more of the activities to small groups instead of to individual students.

3. Give fewer or more choices.

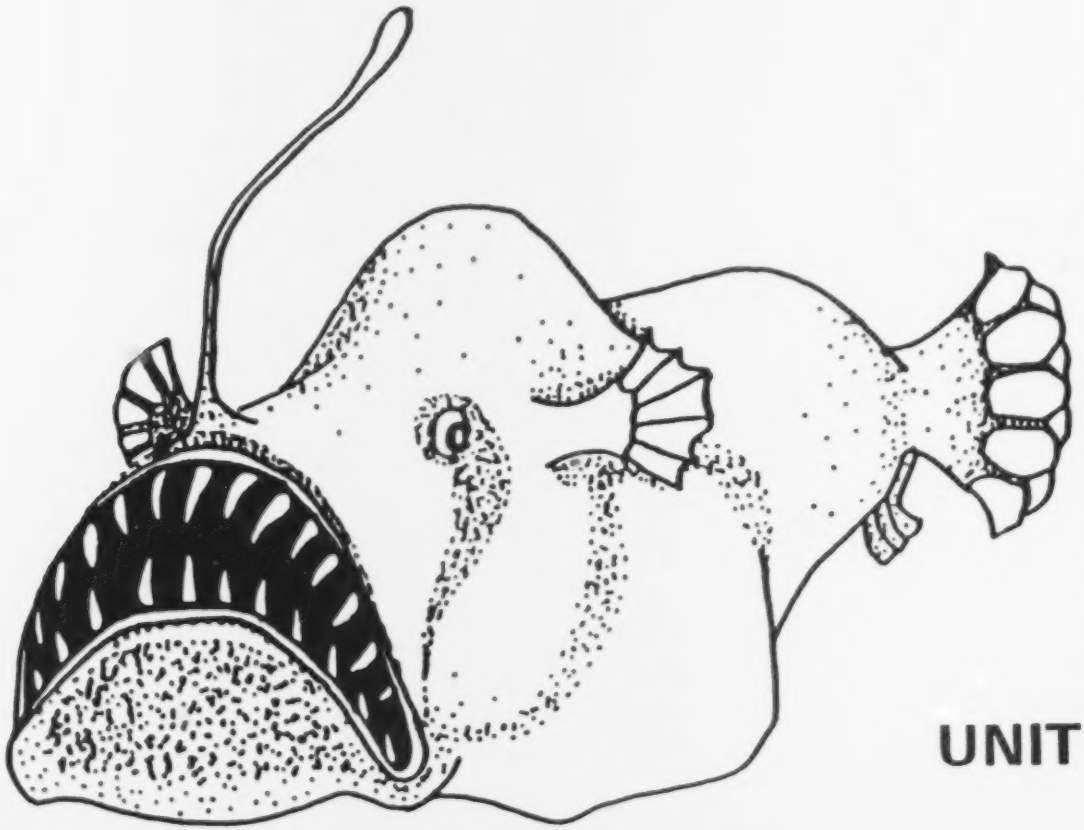
4. Delete some activities altogether.

5. Arrange the unit to be a class project with students choosing different parts to complete.

6. Add some activities of your own.

Name _____

Date _____

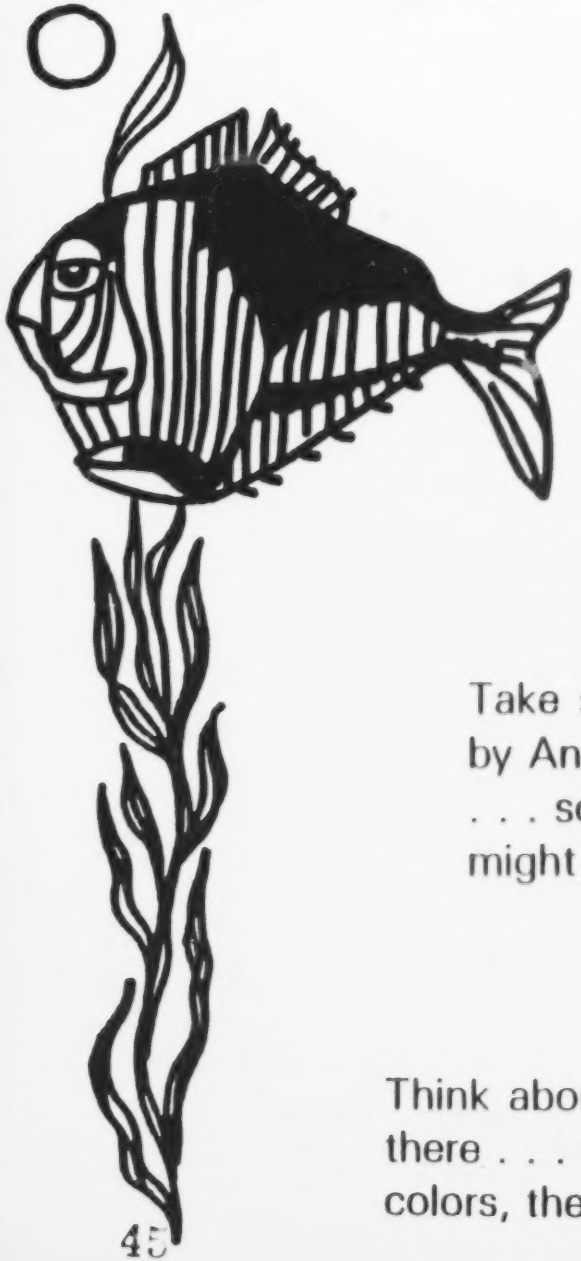


UNIT II

MARINE BIOLOGY

The following pages are to be reproduced for use in your classroom. You may want to copy directly from this book or cut the pages out first . . . then keep them in a folder to use another year.

1 SETTING THE STAGE



"The ocean . . . offered us an incessant and infinite display of its most marvelous treasures. There was a continuous change of decor and scenery, as if staged to please our vision, and we were called upon not only to contemplate the works of the creator in this expanse of liquid world, but also to delve into the most redoubtable mysteries of the sea."

Jules Verne
Twenty Thousand Leagues Under The Sea

Take some time for quiet . . . listen to "The Ocean" by Anton Rubenstein . . . "Le Mer" by Claude Debussy . . . some sea chanteys . . . and any other music that might set the mood for a study of the sea and its life.

Think about the quote by Jules Verne. Imagine yourself being there . . . include imaginings of the sounds, the smells, the colors, the shapes . . . .

2 GO.... TO THE LIBRARY

Collect as many "mermaid" stories as you can. Be sure to include Hans Christian Anderson's **Little Mermaid** and Jean Giradoux' **Ondine.**

OR

Find the answers to these legendary facts:

- Why does the mermaid look into a mirror?
- Why is there salt in the sea?
- In the Fiji Islands, what do they give as the reason for the fowl crowing?
- How did the coconut come to be created?
- Why do fish open and close their mouths?
- Why does the jellyfish have no shell?
- Why is the water warm below the surface of the sea?

Create a way to communicate your findings (Filmstrip, tape recording, a series of one-act plays . . .). Present your product to the group of your choice.

3 RESEARCH AND REPORT

CHOOSE ONE

Explore the problem of the balance of nature as it applies to sea life.

Investigate products used by man . . . . that originate in the whale. What part of the whale is used for each product?

Research the Challenger – what it was – what it became – where it traveled . . . what were the results?

Research the many areas of the sea – the reef, the abyss . . . become familiar with the sea life found in each.

Report on the topic in the way of your choice

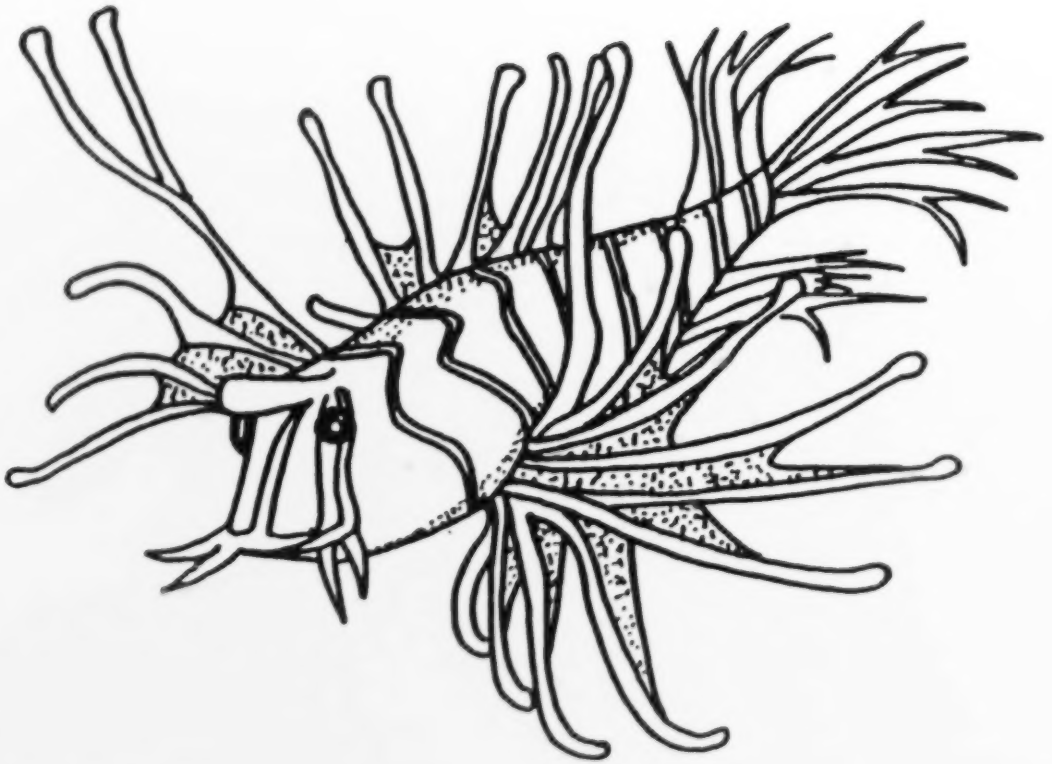
- [ ] A magazine type article
- [ ] A filmstrip
- [ ] A tape recording

4 CLASSIFY – LIST – RANK

Research symbiotic relationships observed in the sea. Separate your findings into "commensalism" and "parasitism" symbiosis.

OR

Find out about sedentary feeders. Make a chart diagramming their environment. Be sure to distinguish and label their different methods of collecting food.



OR

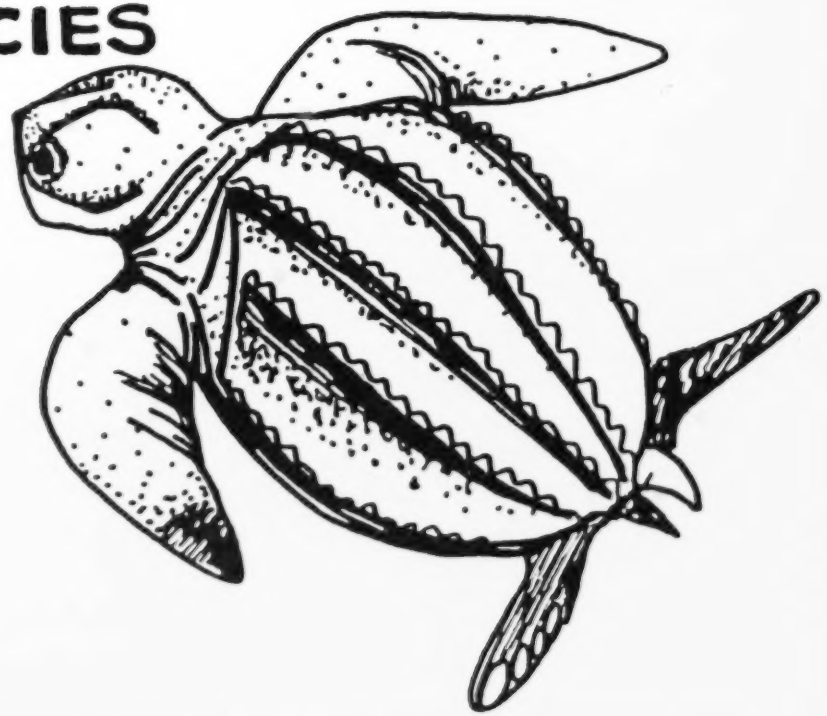
Research poisonous sea life. Rank, illustrate and label them according to the degree of venom and their danger to man.

OR Select 3 to 5 common varieties of the whale. Make a model of each one . . . classify and label them.

OR Put together a collection of at least twelve varieties of shells. Classify and label each one.

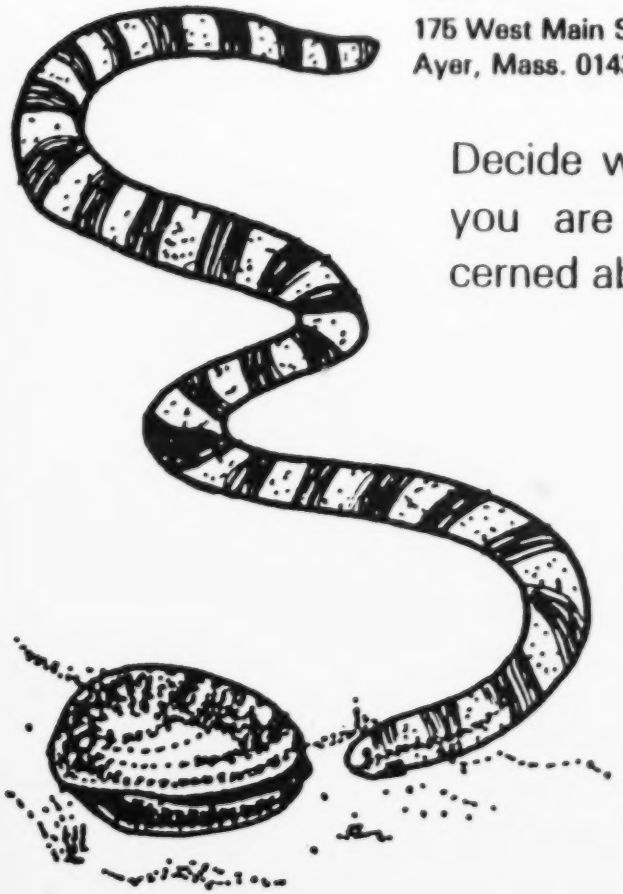
Find some books, film strips and illustrations on the subject and set up a display in the library.

5 ENDANGERED SPECIES



INFORM YOURSELF
about endangered species of the sea
by writing to –

The Center for Action On Endangered Species, Inc.
175 West Main Street
Ayer, Mass. 01432



Decide which animal you are most concerned about.

INFORM OTHERS about the problem by:

- ☐ Writing a news article
- ☐ Writing a TV or radio commentary
- ☐ Putting together a poster
- ☐ _____
  (your idea)

PRESENT YOUR PRODUCT TO SOMEONE WHO MIGHT USE IT!

6 FIND OUT (CHOOSE TWO)

— **WHICH** sea animals can break the pressure barriers?

— **WHAT** are some superstitions that are inspired by the sea urchins?

— **HOW** might the dolphin be used in naval intelligence?

— **WHAT** is the curious story of the tilefish?

— **WHAT** is the purpose of the International Whaling Commission?

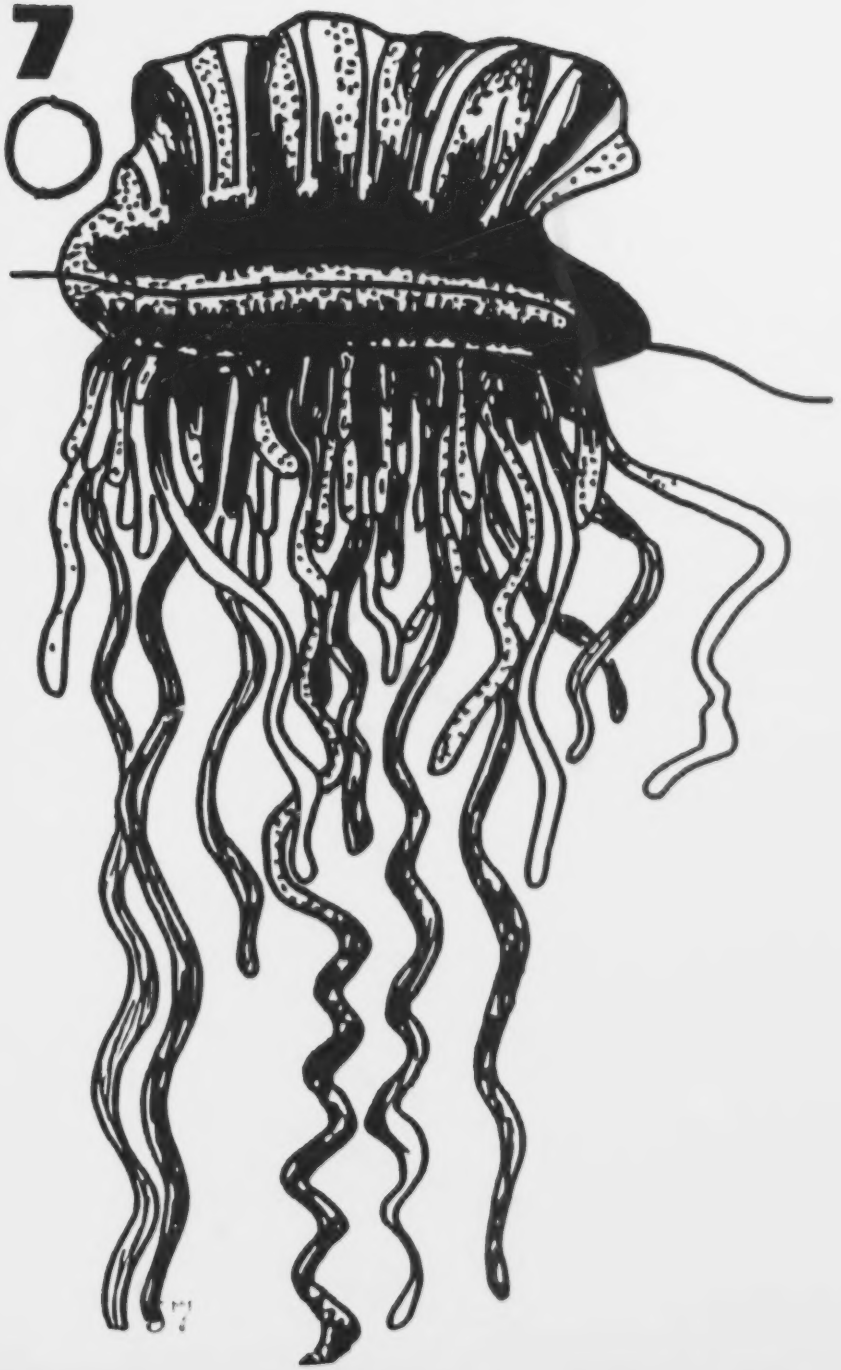
— **WHAT** is the meaning of "Predators follow predators that follow predators."?

— **WHAT** is the relationship of the crown-of-thorns to the coral reef?

— **WHAT** is the function of the "lateral line" organ?

CITE YOUR SOURCE OF INFORMATION.

7

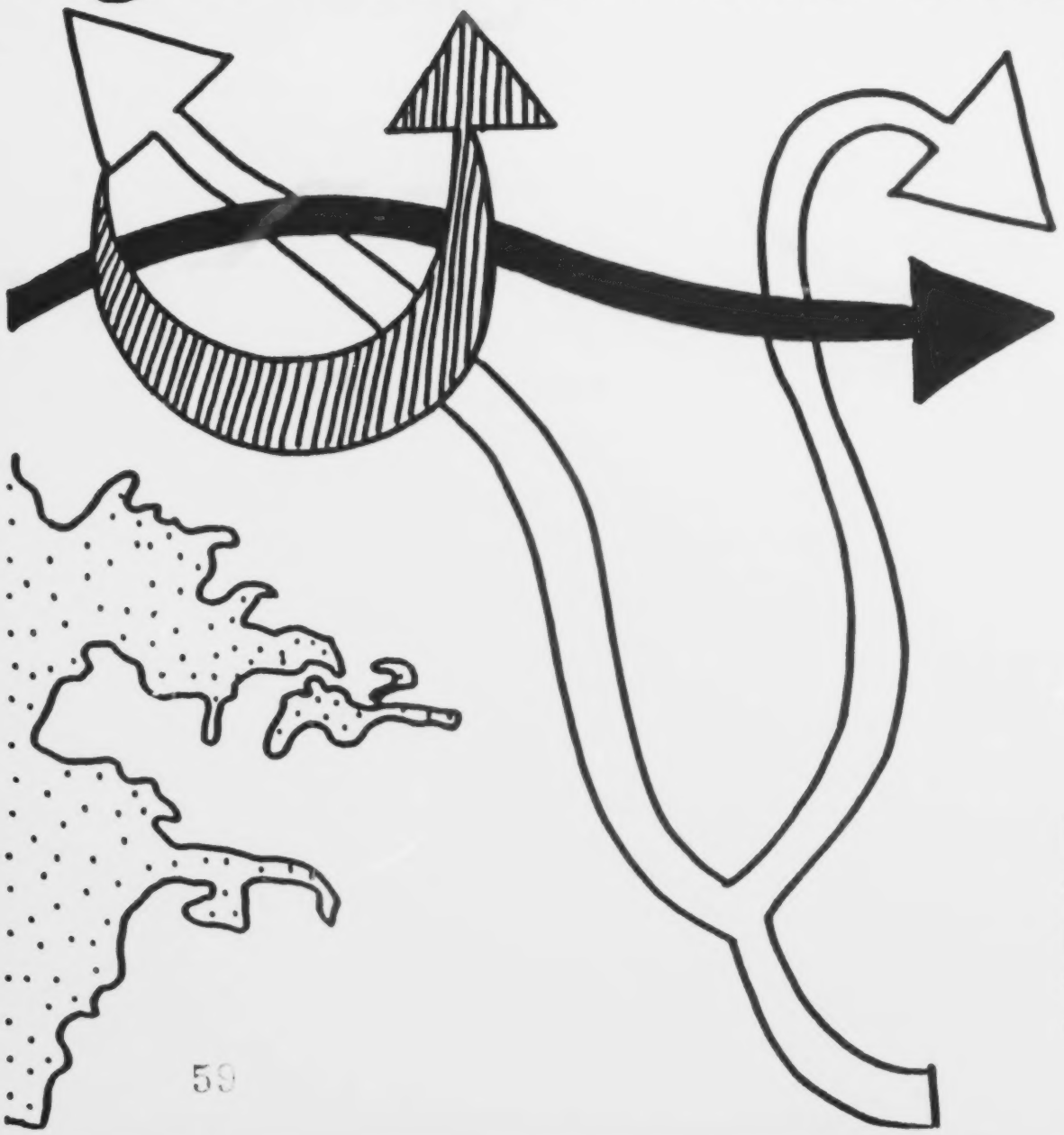


CREATIVE WRITING

WRITE an imaginary story, poem or song based on factual information, using one of these topics. (If you have one you like better, use it!)

- The rule of marine life — to survive and to perpetuate his kind —
- The ritual of the Caribbean spiny lobster —
- The family life of the seal —
- The salmon and its life cycle —
- Unusual behavior patterns of marine life.
- _____

8 MAPPING..TIME LINES



- **DRAW** a map of the earth showing:

  spawning grounds (label kinds of fish and type of eggs produced)

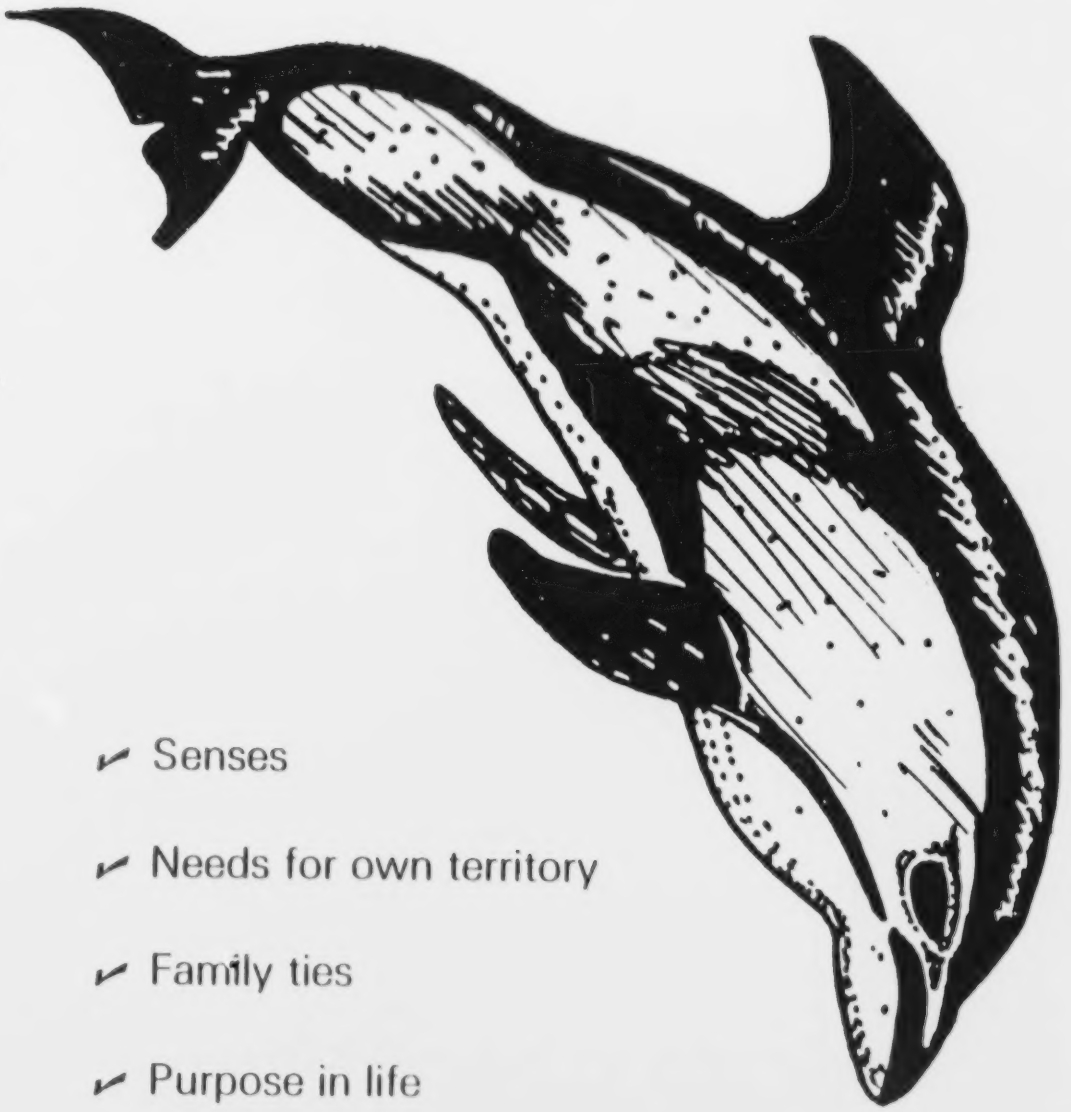
  OR

  migration paths of sea life

OR

RESEARCH the history of the study of marine biology. Prepare a time line showing the significant events beginning with the first century A.D.

9MAN AND ○DOLPHIN



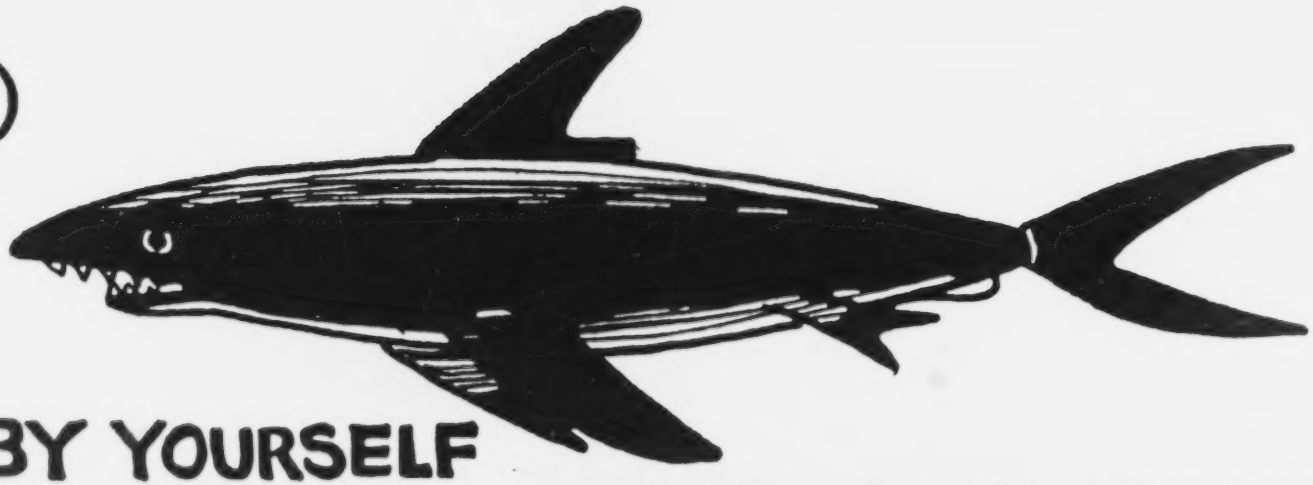
CONTRAST AND COMPARE
the lives of man and the dolphin.

SHARE YOUR FINDINGS
in a way that you choose.

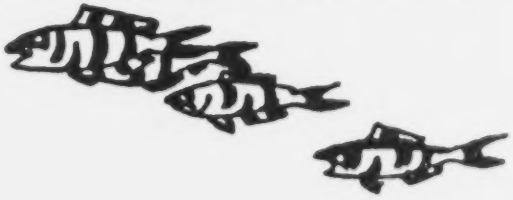
BE SURE TO INCLUDE:

- ✔ Gestation time
- ✔ Length of parental protection
- ✔ Age when weaned
- ✔ Age of sexual maturity
- ✔ Senses
- ✔ Needs for own territory
- ✔ Family ties
- ✔ Purpose in life

10



BY YOURSELF OR WITH SOME FRIENDS



In the myths and stories of ancient times, the sea was often seen as a source of divine power.

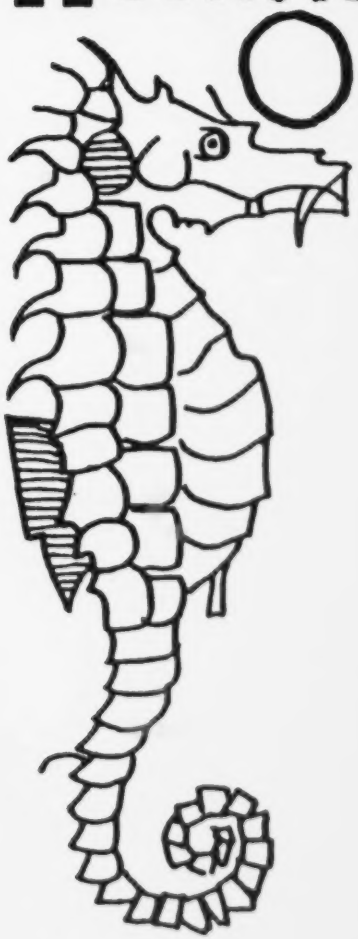
Find references (at several points in history, if possible) about some of the following:

- ✔ The mermaid
- ✔ The sea nymph
- ✔ The Poseidon
- ✔ Sedna
- ✔ The dolphin
- ✔ The whale

CREATE A WAY TO SHARE YOUR FINDINGS.

11 CONTRAST AND COMPARE

CHOOSE ONE



DISCOVER what is alike and what is different about the "true" and the "soft" coral. **AND** what are the stages of growth of a coral colony from the original parent . . . to the coral skeleton.

CONTRAST and compare the salmon and lamprey.

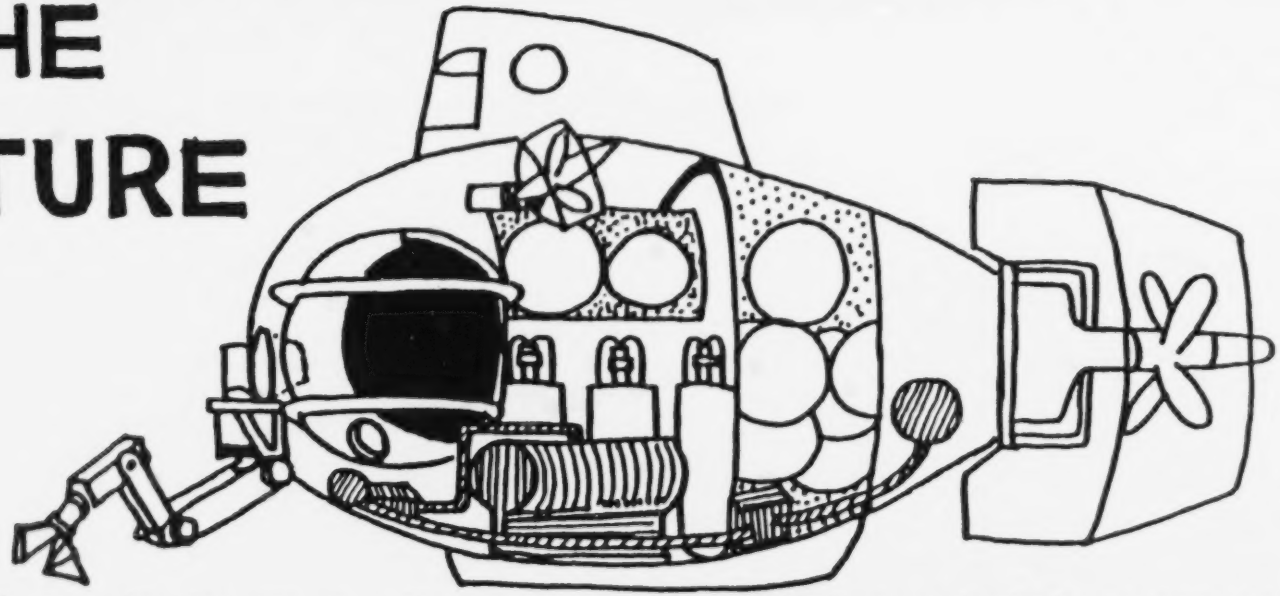
TRACE the fish as it appears in myths and religion. Select several of these and consider what is alike and what is different.

CONTRAST and compare Earth and Mars as they relate to the availability of water. Speculate about the possibility of marine life on Mars.

CONSIDER the similarity of salt content in human blood and sea water. What conclusions have been drawn from this?

COMPARE the methods of the jellyfish and the anemone in securing "prey".

12 THE FUTURE



RESEARCH man's future as it relates to the sea.
How will the sea be of value to man?

WRITE a scholarly presentation of *your* views in light of the scientific study so far.
Cite at least 5 sources.

AND THE PAST

—CHOOSE ONE—

IMAGINE it is 3 billion years ago. Write *your* story of the beginning of life on this planet.

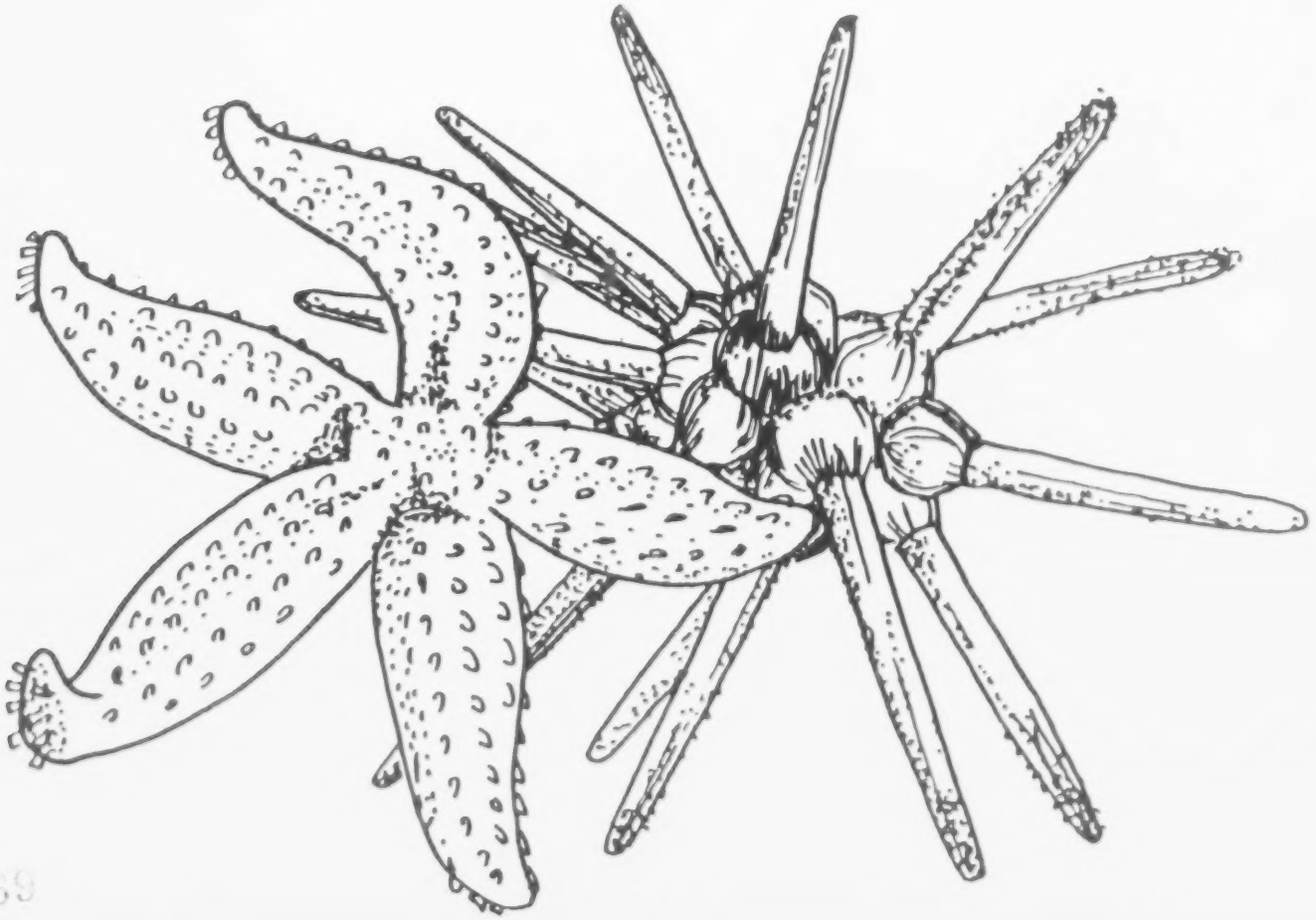
INCLUDE your thoughts about whether it was an accident or whether there is a plan and purpose to life . . . or both.

WRITE a convincing argument for your ideas . . . cite at least 5 sources that may or may not concur with what you believe to be true.

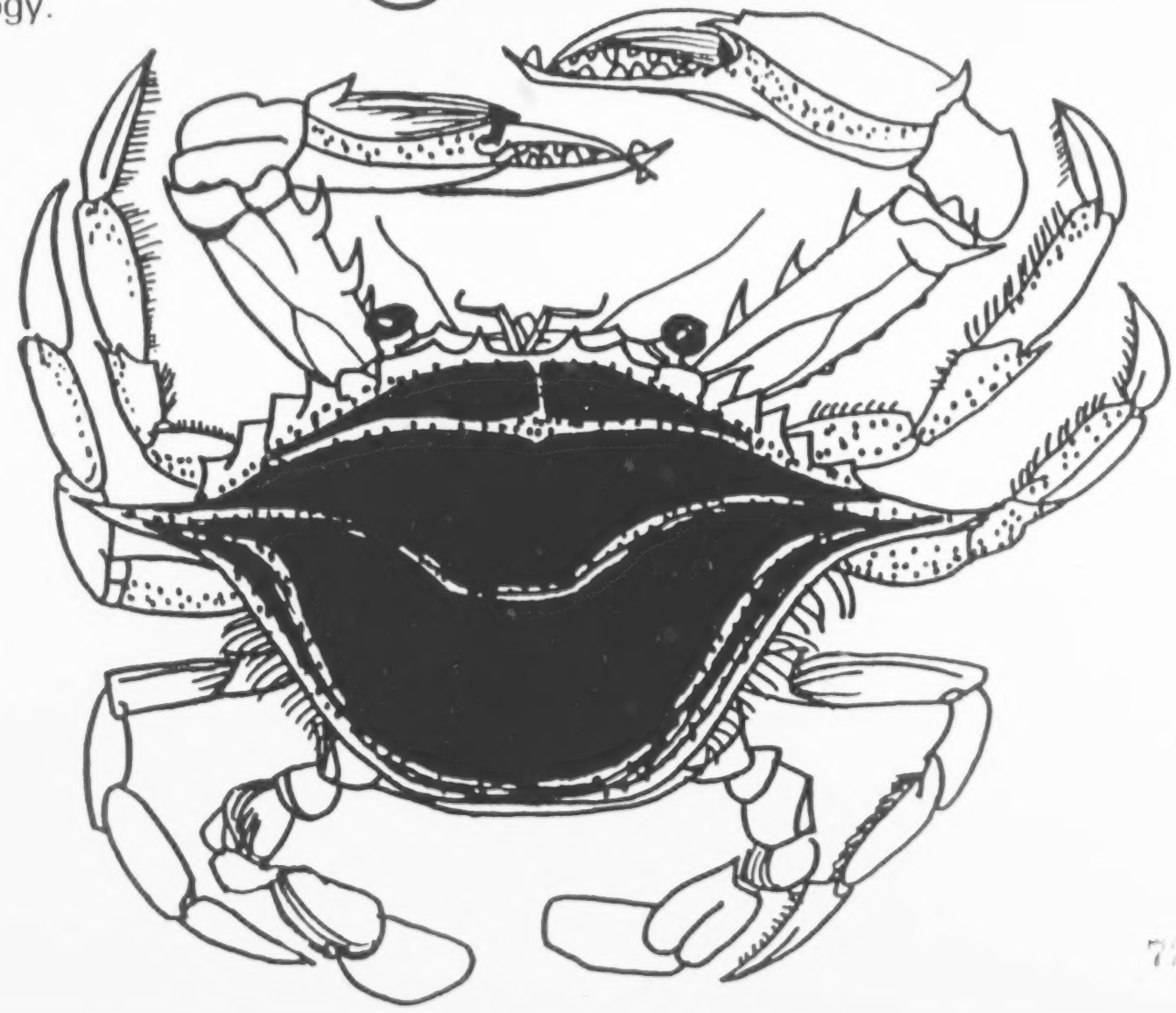
13 COMMUNICATION

PREPARE and present a debate on the topic —

"Man-Dolphin Communication . . . Imagined or Real?"



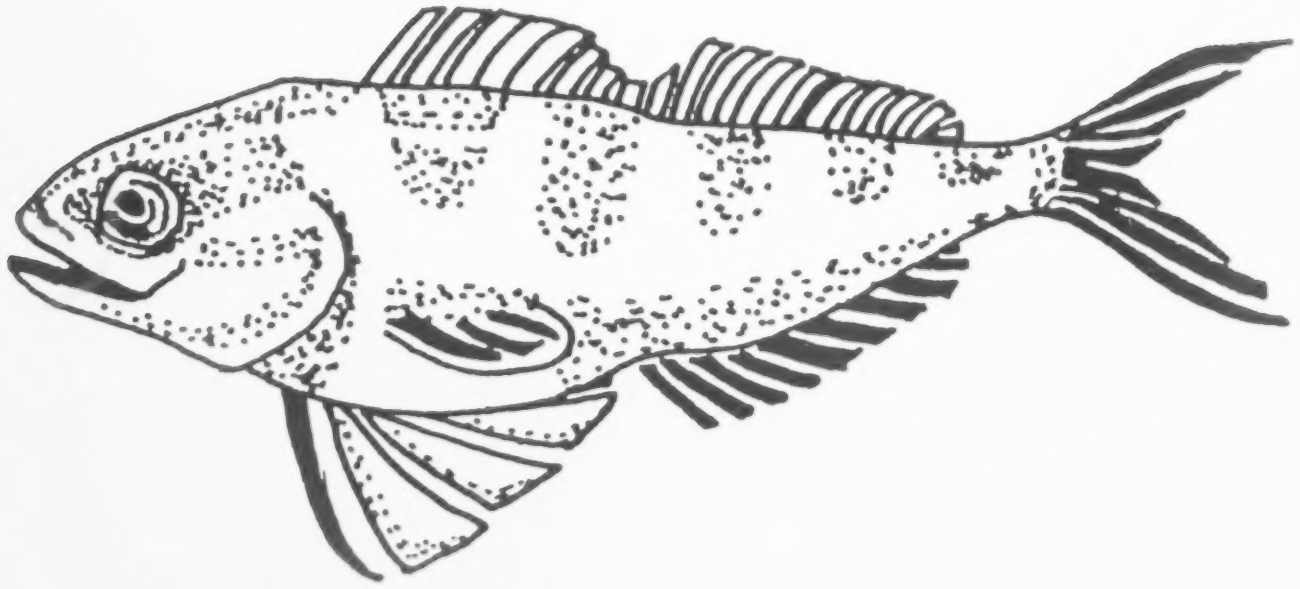
DEVISE a word game using a minimum of 10 terms common in marine biology.



14 ○ FIND OUT ABOUT

some careers related to
marine biology.

Which is most suited to you?



15 ART...CRAFTS...BUILDING.

CHOOSE AT LEAST ONE!

FIND OUT why the manatee would be welcomed in Florida. Make a poster or banner welcoming the manatee . . . be sure it indicates the reason!

FIND OUT about the coelacanth. Create a replica and write about its history. Display your work.

WITH some friends or by yourself, create a mural illustrating the marine biome and its inhabitants. Show the food chain "in action" within each region.

WRITE a puppet show about underwater life. Make the puppets and present the show . . . mermaids, a magic fish, a treasure . . . what will it be?

IN any medium you choose . . . water color, collage, wax paper and melted crayon . . . show the mood of the under-water sea.

PREPARE a sheet of drawing paper for "scratch art". (Using any crayon except black, color the paper solid. Then color over with black.) Scratch an underwater scene of:

- ☐ plankton
- ☐ jellyfish
- ☐ mollusks
- ☐ sea urchins
- ☐ starfish
- ☐ tropical fish
- ☐ sea weed
- ☐ any combination of any of these

Enjoy the painting "Fish Magic" by Paul Klee, if you choose this one.)

16 LOOKING TOWARD THE FUTURE

REACT to the statement made 100 years ago by Thomas Henry Huxley, English biologist:

"I believe probably all the great sea fisheries are in exhaustible; that is to say that nothing we do seriously affects the numbers of fish."

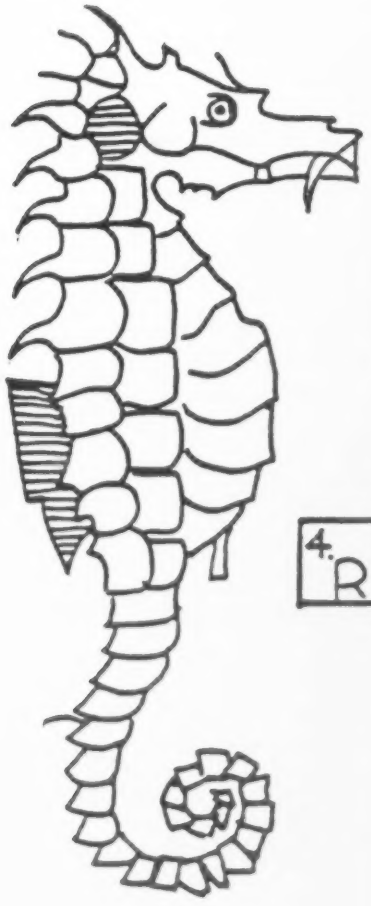
RESEARCH to find at least eight changes on the planet that proved this to be wrong . . . include technological advances, fishing methods and others. Evaluate these changes and decide:

. . . which have made the greatest impact?
. . . which could be controlled . . . how?
. . . what, if anything, should have been done differently?

WRITE a news item presenting your findings. Get it published if you can.

KEY

WORDS FROM THE SEA



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MARINE BIOLOGY
BIBLIOGRAPHY

JUVENILE

Burton, Maurice and Jane — **SEA LIFE**, a comprehensive view of the subject with outstanding photography.

Bridges, William — **WATER WORLD**, a well-indexed guide in color, to our underwater world.

Fenten, D.X. — **HARVESTING THE SEA**, a look at how the sea can help man meet his growing needs.

Harter, Walter — **DEADLY CREATURE OF THE SEA**, many unusual facts about dangerous sea animals.

Jacobs, Francine — **SOUNDS IN THE SEA**, includes underwater waterfalls, fish and mammals.

Limburg, Peter R. & Sweeney, James B. — **102 QUESTIONS & ANSWERS ABOUT THE SEA**, answers almost everything you want to know.

List, Ilka Katherine — **SEASHORE LIFE**, answers to unusual questions about seashore animals.

Lucas, Angela & Derek — **FOCUS ON OCEANS**, a geological look well illustrated and easily understood.

Rood, Ronald — **THE SEA – ITS WONDERFUL CREATURES** a comprehensive look with easy reading.

Shepherd, Elizabeth — **TRACKS BETWEEN THE TIDES**, stones of sea worms and other burrowing animals.

Thompson, Brenda & Overbeck, Cynthia — **UNDER THE SEA**, marine biology for the very young.

Vessel, Matthew F. & Wong, Herbert H. — **SEASHORE LIFE OF OUR PACIFIC COAST**, the usual and unusual and their interesting habits.

Zim, Herbert S. & Ingle, Lester — **SEASHORES**, a guide book to fresh and salt plant life along the beaches.

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Zim, Herbert S. & Abbott, R. Tucker — **SEA SHELLS OF THE WORLD**, a guide book to better known species.

ADULT

Angel, Martin & Heather	**OCEAN LIFE**, outstanding photographs and descriptions of the ocean environment.
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Cousteau, Captain J.Y.	**THE LIVING SEA**, the story of an underwater expedition aboard the "Calypso".
	THE OCEAN WORLD OF COUSTEAU SERIES, Volumes 1-20
Cousteau, Jacques Yves & Diole, Philippe	**OCTOPUS AND SQUID: THE SOFT INTELLIGENCE.**
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Rudloe, Jack	**THE EROTIC OCEAN: A HANDBOOK FOR BEACHCOMBERS**
Sandved, Kjell B. & R. Tucker Abbott	**SHELLS IN COLOR.**
Starck, Walter A.	**THE BLUE REEF: A REPORT FROM BENEATH THE SEA.**
Vevers, Gwynne.	**LIFE IN THE SEA**, a comprehensive study of sea life.

FOR YOUR ARTISTIC PLEASURE

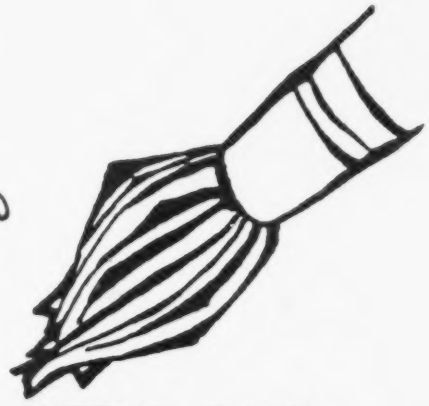
HIROSHIGE: A SHOAL OF FISHES	from the Metropolitan Museum of Art . . . first published in 1832-33 twenty woodblock prints of fishes by Ando Hiroshige with accompanying descriptions and poetry.
THE FISHES	another Brian Wildsmith beauty of color and design.

FICTION

Giradoux, Jean	ONDINE
Hemingway, ERnest	THE OLD MAN AND THE SEA
Melville, Herman	BILLY BUDD
Mishima, Yukio	THE SOUND OF WAVES
Verne, Jules	TWENTY THOUSAND LEAGUES UNDER THE SEA

81

Also, see the works of Joseph Conrad, Eugene O'Neill and James Fenimore Cooper.



ART SUPPLEMENT

an opportunity to integrate art experiences within an academic content area

by Stephany Grassinger

While each component... the self-directed learning unit and Exploring the Arts... is a complete and valid learning experience in itself, together they provide a more comprehensive and lasting educational experience for the learner.

GO TO THE LIBRARY

LOOK at pictures of marine animals.

LOOK for the elements of design in five of your favorite animals.

ELEMENTS OF DESIGN

color
line
shape
texture

DISCUSS each animal you chose with a friend or two.

LIST your observations.

DO a drawing with crayons or oil pastels of an underwater scene. Draw marine animals and plant life. Invent some living creatures of your own.

COLOR your drawing with heavy strokes. Use water color paint for the water. Wash the watercolor paint over your entire drawing. The heavy crayon will resist the paint. The paint will stain the paper wherever you did *not* color. This is called **Crayon Resist.**

IMPORTANT — Wash your paint on lightly.
Do not "scrub" it.

MAKE A SCULPTURE

INVENT AN ANIMAL!

Let all of the research you have completed inspire you with an idea. Invent a marine animal. Make a sketch of your idea.

Use newspaper, cardboard, egg cartons, etc. to build your animal. Tape or string is good for holding sections together. The newspaper base is called an **armature**. Cover the armature with strips of newspaper dipped in papier-mache. Give it two coats or layers. The papier-mache will dry in a day or two. When the sculpture is dry, sand any rough spots you may have with a fine grade sandpaper. Now you are ready to paint. Paint your animal. Put on a few finishing touches with felt, beads, tissue paper, etc.

LOOK at a painting by Paul Klee called "Fish Magic".

READ about Paul Klee's life and work. Why do some people say his work is "child-like"? Is that good or bad?